of "Volumetric Gas Analysis," are not exercises in the volumetric as contrasted with the gravimetric analysis of gases, but have to do with the analysis of solids and liquids by measuring the volumes of gas set free from them. In this section, for instance, are described the methods of estimating nitrates by the Lunge nitrometer and analogous processes. The book is presented in an attractive form, and carries out admirably the purpose of the author and translator to provide an introduction to the larger standard works on gas analysis.

(4) The German treatise on the theory and practice of the gas industry is a large work of which the present volume constitutes "I. Band, I. Hälfte." It includes the historical development of the principles of mechanics and physics, and the fundamental laws of thermodynamics. The subjects treated include isothermal and adiabatic compression, change of state, evaporation and boiling, viscosity of gases and vapours, specific heats, entropy of water-vapour and vapours used in refrigeration, radiation and conduction, flow of liquids, vapours, and gases. The chemist or engineer who is called upon to handle gases on a large scale will find in this treatise all that he is likely to require in the way of scientific preparation for his work.

(5) Prof. Sackur's "Text-book of Thermochemistry and Thermodynamics" deals with the fundamental laws of heat and of thermodynamics, which are then applied to many of the chief problems of physical chemistry. Thus we find chapters devoted to the theory of solutions, including van't Hoff's equations for osmotic pressure, and to chemical equilibrium based upon the equations of Helmholtz and of van't Hoff, and applied, for instance, to calculate the heat of ionisation from the change of the ionisation-coefficient with temperature. There are also chapters on the applications of thermodynamics to electrochemistry, thermoelectricity, and capillarity. The last chapters deal with radiation and with Nernst's "heat-theorem."

(6) The "Foundation Course in Chemistry" of Messrs. Dodgson and Murray is a well-written book of rather exceptional character. Special attention is paid to topics which have an interest for agricultural students, but this is by no means a drawback from the point of view of the general reader, as it gives an air of reality to the whole treatment of the subject. Structural formulæ are freely used for inorganic as well as for organic compounds, and a long chapter is given up to the chemistry of aliphatic compounds under the title "Paraffins and their Derivatives." The chapter on general principles gives a clear exposition of the doctrine of equivalents, but is scarcely an adequate exposition of the atomic theory, as Avogadro's hypothesis, which is the real basis of the modern system of atomic weights, is postponed to a later chapter, and is there treated only in the most incidental manner.

(7) The modern system of examinations is responsible for the development of a form of qualitative organic chemistry in which attempts are made to determine the nature of organic compounds without carrying out a combustion or quantitative analysis of any sort. This type of organic chemistry is only distantly related to the requirements of scientific or technical research, and has only a very limited range of usefulness. But if the student is aware of the supreme necessity of quantitative work there is little harm in allowing him to get some practice in recognising the qualitative properties of the chief radicles. Mr. Shepherd's book gives a scheme whereby the most important groups of organic compounds may be identified by qualitative tests; the scheme has been in use for some years, and has thus been adequately tested by actual work in the laboratory.

OUR BOOKSHELF.

A Text-book of Experimental Metallurgy and Assaying. By A. R. Gower. Pp. xiv + 163. (London: Chapman and Hall, Ltd., 1913.) Price 3*s*. 6*d*. net.

THE new edition of this book conforms to the syllabus of the Lower Examination in practical metallurgy of the Board of Education. The first portion of the book consists of a series of experiments and explanations to illustrate the reactions occurring in various metallurgical operations, while the second part deals, in quite a satisfactory manner, with elementary assaying. It would have been an advantage if the book gave a little more guidance to the beginner, for very often he does not realise the economic character of metallurgy. For instance, a student sometimes thinks that as sodium carbonate is used in the laboratory as a flux for silica, therefore it would be charged into a blast-furnace smelting copper ores when silica has to be removed. The first chapter of this book may give some students an impression of this kind, for the substances classed as used in metallurgical operations are not all commonly so employed, although frequently used in experimental metallurgy and assaying. Then, again, in the chapter "Formation of Alloys," the theoretical quantities of the metals have been given, and no allowance made for loss in the case of volatile metals.

During the past twenty-five years the book has proved of use, and the present edition should be of assistance to those preparing for the Board

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of Education examination, and if the exercises are performed under the supervision of a teacher, none of its minor defects will cause the beginner to gain wrong impressions.

Ministère de l'Agriculture. Direction Générale des Eaux et Forêts. 2e partie. Eaux et Améliorations Agricoles. Service des Grandes Forces hydrauliques dans la Région des Alpes. Résultats des Etudes et Travaux à la Fin de 1911. Tome v., 1912. Pp. 530.

THE present volume is the fifth of the series published by the French Ministry of Agriculture since the inauguration of the Service of the Great Hydraulic Forces in Alpine regions, and it brings the account of operations down to the end of the year 1911. Of the 530 pages of which the volume consists, 487 are devoted to a tabulation of the results obtained from observations in the basins of the Arve, the Fier, the Isère, and the Drôme. A series of nine charts also accompanies the report, covering the regions of the Arc, the Breda, the Durance, and the Guil.

It is interesting to note the expedients and devices by which an investigation, demanding for its most effective development the employment of expert scientific observers, has been enabled to be carried on to a large extent by voluntary workers and local auxiliaries, for the most part untrained and indifferently coordinated. Such agencies in many cases have had to be relied upon for the collection of data, and as there is a constant change of personality in the assistants, the difficulties in the way of securing trustworthy records are sufficiently obvious.

"However," concludes the prefatory note, "in spite of defects, of which we more than anyone are conscious, we are convinced that the study of hydraulic forces, so far as circumstances permit, constitutes none the less a real utility"—and a cursory glance through the pages of statistical matter, carefully annotated and compiled, bears incontestable witness to the patient labour and exactitude of those engaged in the French hydrographical service and of M. de la Brosse, its chief engineer.

Weather Bound. By R. T. Smith. Pp. 319. (Birmingham: Cornish Bros., Ltd., n.d.) Price 15*s.* net.

THE author gives, in great detail, summaries of results of twenty-seven years' observations at five stations situated to the west of Birmingham, in a series of tables and diagrams occupying 170 pages. He adds a diary, "Weatherwise and Otherwise," for the same period, which occupies sixty pages, and explanatory text (seventy-two pages). He also gives a diagram of the normal course of the meteorological elements throughout the year, which is unintelligible owing to want of explanation. The amount of industry displayed is worthy of praise, and most of the tables appear to contain climatic data of real value, but the author's exposition cannot be recommended to the attention of serious students of meteorology.

R. C.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

Radio-activity and the Age of the Earth.

IN his letter in NATURE of June 26, Dr. Schiller quotes with disapproval Mr. Holmes's deduction that the "heavy metallic core" of the earth "must be completely destitute of radium"; for this deduction, in Dr. Schiller's opinion, "involves the improbability that the heaviest metal of all, uranium, has not gravitated to the 'metallic core,' and does not explain why this core should be destitute of radio-active substances."

In the next paragraph, however, Dr. Schiller suggests a possible escape from the difficulty with the words, "it is possible that under the physical conditions obtaining in the interior uranium does not dissociate, or does so much more slowly."

Last autumn, as a sequel to certain speculations into the effects of pressure on the mineralogical constitution of the earth's crust at great depths, I was led to a consideration of this very question of the dissociation of elements when subjected to the high temperatures and pressures that prevail at such depths.

So far as I was able to discover, no determination of the specific gravity of radium had then been made, presumably for lack of sufficient material; but, judging from its chemical relationship with barium, the atomic volume of radium must be much greater than that of uranium. Heat is known to be evolved during the disintegration of radium, so that the break-up of this element is an exothermic change. I am writing this letter whilst travelling, and am, consequently, unable to verify my impression that heat is also evolved during the conversion of uranium into radium. But in any case, the passage of uranium into radium may be expressed in a general way by some such equation as the following:—

$$\mathrm{U}=\mathrm{Ra}+m+e,$$

where m indicates the loss of mass due to liberation of helium in the successive stages of disintegration, and e the loss of energy represented by the various manifestations of energy. Since radium has a higher atomic volume than uranium we see that the progress of this reaction from left to right means an increase in volume and an evolution of energy, part of which is doubtless speedily transformed into heat. In fact, it is exactly the kind of reaction that would be inhibited by high pressure and temperature conditions.

That high pressure should be able to prevent the disintegration of uranium seems reasonable, if one accepts the electronic constitution of the atom. Judging from the extreme length of the half period of disintegration of uranium under surface conditions, the constituent electrons of an atom of uranium perform on the average a vast number of revolutions before the system arrives at the position of instability that permits the escape of a helium atom. In fact, the uranium atom is evidently stable during an enormous number of revolutions or vibrations. And if, when the electronic system arrives at last at an unstable configuration, a sufficiently powerful counterbalancing force can be applied from without, then the system will be helped past the danger point and be able to commence another long cycle of movements before the dangerous configuration is again assumed.

In view of the experiments of Humphreys and Mohler upon the displacement of the spectral lines, and the work of Richards on the com-

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